

rately from the fundamental, unless special means be adopted to render them audible, but they add their vibrations to those of the fundamental.

When two sounds are heard simultaneously, they give a concord, or a discord, but each may be separately distinguished by the ear. Two colours, on the other hand, produce a single impression on the eye, and it is doubtful whether we can analyse them. But smell resembles sound and not light in this particular. For in a mixture of smells, it is possible, by practice, to distinguish each ingredient, and as I have shown, to match the sensation by a mixture.

With regard to the mechanism by which smell is conveyed to the nerve, all that can be said is pure speculation. But as it is supposed that the vibrations of sound are conveyed to the auditory nerve through the small cirrhi, or hairs which spring out of round cylindrical nerve-cells in the superficial layer of connective tissue of the epithelium of the internal ear, and that each is attuned to some particular note of vibrations, so it may be imagined that the hair-like processes connected with the spindle-shaped cells, themselves communicating with the nerve-fibres of the olfactory nerve, are the recipients of the vibrations causing smell. Although the rate of such vibrations is extremely rapid, no less indeed in the case of hydrogen than 4,400,000,000,000,000, or the four quadrillions, four trillionth part of a second, yet the wave-length is by no means so small, for it averages the 2-100th of an inch, a magnitude quite visible with the naked eye. And hydrogen has no smell; those bodies which have smell, and higher molecular weight, must necessarily have a slower period of vibration, and possibly greater wave-length.

It is doubtful whether there exists a lower limit to our sense of smell. The vapours of osmic acid, carbon tetrabromide, selenium, tellurium, and arsenicous and antimonious oxides are among the heaviest known, and they have a most distinct smell. There appears to be a limit in practice, however, owing to the non-volatility of substances of high molecular weight at such temperatures at which smell may be perceived. The intense perfume of flowers is to be ascribed to the terpenes, of which common turpentine is one, or to their products of oxidation, and these bodies all possess a molecular weight of 136, and the specific gravity 68, a specific gravity which appears to excite the olfactory nerve most powerfully.

I bring forward the theory adduced with great diffidence. The problem is to be solved, in my opinion, by a careful measurement of the "lines" in the spectrum of heat-rays, and the calculation of the fundamentals, which this theory supposes to be the cause of smell. Such measurements and calculations, even if they proved the theory untenable, would have great value for their own sake, and labour expended in this direction would not be lost. Whether successful or not, it would at least be a first assault on what old John Bunyan called "Nose-gate of the City of Mansoul."

WILLIAM RAMSAY

University College, Bristol

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

CAMBRIDGE.—A syndicate, on which Dr. Ferrers, Prof. Stokes, Prof. Balfour, Mr. Todhunter and Mr. Trotter may be taken to represent the interests of science, has been appointed to frame regulations for the new degrees of Doctor of Science and of Letters. Candidates for these degrees are required by the new statutes to have made some original contribution to the advancement of science or of learning.

In the last Mathematical Tripos under the old regulations (January, 1882) the full marks were 27,150, and the average marks of the first ten wranglers were 6712, of the last ten 2890; first ten senior optimes average 2093; first ten junior optimes, 818. Out of 1407 marks given to the problems in the first three days, the first ten wranglers gained an average of 255; out of 8161 given to the problems in the last five days, the same ten averaged 849.

An important report by Mr. G. H. Darwin, who was the additional examiner in the same tripos, criticises severely the style in which the work of many men was done. Not a few sent up answers in atrocious handwriting, and omitted to define many symbols employed. The subjects which exhibited the average weakness of grasp most flagrantly was thermodynamics. A great many men had read something of it, but very few really understood what they attempted to explain. "Extraordinary muddle and confusion" was sent up in answer to a question on

the absolute scale of temperature. On another question, while the very elements of the subject were unknown to those who answered, the same men reproduced faultlessly the algebraical calculation of the thermodynamic function for a perfect gas. Mr. Darwin strongly recommends such changes in the style of questions as that half intelligence may be more stringently treated, and men induced to read less and master more, and to gain a comprehension of physical principles.

The affiliation of University College, Nottingham, to Cambridge University has been formally recommended, so soon as the constitution of its governing body has been altered so as to admit a representative of the University. Scientific subjects have full recognition in the college course of study, by which exemption from one year's residence at Cambridge may be obtained, provided the student takes a degree in honours.

When Statute B comes into operation, the present Board of Natural Science Studies is to be replaced by two Boards—that of Physical and Chemical Studies and that of Biological and Geological Studies. These Boards will include, besides the Professors and Readers belonging to these studies, the Tripos Examiners of two years in the respective subjects belonging to the Boards, and three members of the Senate elected to serve for three years.

The second part of the Natural Sciences Tripos this year has no name in the first class, a result probably attributable to the transition state of the Tripos. Next June a better result may be anticipated, unless students with one consent let alone the more advanced parts of all the subjects. If this is the consequence of the recent changes, it will be much to be regretted.

OXFORD.—The term that has just ended has been chiefly remarkable for the fact that the new Statutes have come into operation in default of obstruction in Parliament. Already at several of the colleges, tutors and lecturers who have vacated their fellowships by marriage, have been re-elected "official Fellows;" and others who hold fellowships under the old ordinances have transferred themselves to the new official class.

But little legislation has been effected in Convocation: the only proposal of the Hebdomadal Council which provoked opposition was that to raise the University dues from five shillings to seven and sixpence a term, and to double the fee for Responses (smalls), making it 2*l.* instead of 1*l.* Both proposals were carried on a division. The new Statute on Private Halls—containing provisions for bringing the master and students of such halls under the direct supervision of the University—was passed after being amended in Congregation. A Statute postponing the date of the University Examinations was also passed; so that in future the final honour schools will not commence before the last week of term.

During Michaelmas term, there will be offered two scholarships for proficiency in Natural Science. At Balliol there will be an election to a scholarship on the foundation of Miss Hannah Brakenbury, "for the encouragement of the study of Natural Science," worth 80*l.* a year (55*l.* and tuition free), tenable during residence for four years: open to all such candidates as shall not have exceeded eight terms from matriculation. This examination will begin on Thursday, November 16, at ten o'clock. Papers will be set in the following subjects:—(1) Mechanical Philosophy and Physics; (2) Chemistry; (3) Biology. But candidates will not be expected to offer themselves in more than two of these. There will be a Practical Examination in one or more of the above subjects, if the Examiners think it expedient. There will also be an optional paper in Mathematics; and the literary qualifications of the candidates will be tested by an English essay, or by a paper of general questions.

At Trinity College one Millard and Combe Scholarship, of the annual value of 80*l.*, without limit of age, will be awarded in October next for proficiency in Natural Science if any Candidate of sufficient merit offers himself. The Scholarship is tenable in the first instance for two years, and will be prolonged for two years more, if the President and Fellows are satisfied with the industry and good conduct of the scholar. For special reasons it may be prolonged for a fifth year. The subjects of examination will be Chemistry and Physics. Candidates may also offer Mathematics, if they wish to do so and give notice a week before the examination. Special weight will be attached to excellence in one or two subjects, rather than to a less thorough knowledge of all. Candidates will also have an opportunity of doing one Classical paper. The scholar elected will not necessarily be required to commence residence

immediately. The President will receive the names of candidates and their testimonials of character on Tuesday, October 10, between 8 and 9 p.m. The examination will commence on Wednesday, October 11, at 9 a.m.

SCIENTIFIC SERIALS

Proceedings of the American Philosophical Society, vol. xix. No. 109, June to December, 1881.—Continuation of notes on an Egyptian element in the names of the Hebrew kings, &c., by S. P. Lesley.—Notes on the geology of West Virginia, by J. C. White.—Biotodynamic notes, III. and IV., by P. E. Chase.—On Alaskaite, a new member from the series of bismuth sulphates, by G. A. König.—The auriferous gravels of North Carolina, by H. M. Chance.—On some mammalia of the lowest eocene beds of New Mexico, by E. D. Cope.—Notes on the Quinneton coal group in Mercer Co. of West Virginia and Tazewell co. of Virginia, by J. J. Stevenson.—Notes on the coal-field near Cañon City, Colorado, by the same.—The brain of the cat (*Felis domestica*); I., Preliminary account of the gross anatomy, by B. G. Wilder.—Exploration of the River Bene with the hitherto unexplored regions of Bolivia, by E. R. Heath.—The names of the Gods in the Kiche myths, Central America, by D. G. Brenton.

The Transactions of the Academy of Sciences of St. Louis, vol. iv. No. 2, 1882.—The hieroglyphic tablet of Pompeii grammatically translated and commented on, by E. Seyffurth.—Notes on North American *Microgaster*s, with descriptions of new species, by C. V. Riley.—Descriptions of some new *Tortricida* (leaf-rollers), by the same.—On certain problems in refraction, by F. E. Nipher.—Magnetic determinations in Missouri during the summer of 1880, by the same.—“Reversion of type” in the diaphragm muscle of the human being, by C. A. Todd.—Epimeris of the satellites of Mars for the opposition of 1881, by H. S. Pritchett.—The genus *Isoetes* in North America, by E. Engelman.—Auroral phenomenon, September 12, 1881, by E. A. Engler.

Revue d'Anthropologie, Paris. Deuxieme, Fascicule (1882), contains:—A paper by Dr. Paul Broca—left incomplete at his death—on so-called Ectromelian monstrosities, or those in whom there is an abnormality, but not an absence, of certain parts of the body.—Contributions to the study of muscular variations in human races, by Théophile Chudzinski. This paper is one of a series, the earlier parts of which appeared in the *Revue* for 1873-1874, and which will be continued in subsequent numbers.—On the cephalometric square, and its mode of application, by Dr. Topinard, who also describes the respective merits and demerits of the methods usually employed by artists to determine the facial angle and its relation to other parts of the body.—On the populations of the peninsula of the Balkans, by the late French geographer and traveller, Guillaume Lejean, sometime vice-consul at Khartoum, and at Massauah. This portion of the author's exhaustive history of the origin and settlements of all the various peoples who have occupied the Hemus peninsula since it was held by the ancient Thracians, ends with the complete subjection, in the thirteenth century of the Slaves by Latin princes holding lands under the Greek Empire.—In a paper entitled “Les Griots,” Dr. Berenger-Féraud describes those itinerant musicians who are to be met with in every part of Central Africa, from the shores of the Atlantic to the Indian Ocean, and who, notwithstanding the low castes to which they belong, constitute a distinct confederation under the authority of a chief, who exercises great authority over its scattered members, and levies a heavy tax for his own use from their general receipts. These people, whose name of Griots is a French corruption of the Oulove word “Gwewonal,” are regarded with fear and repugnance by the negro natives of the lands which they traverse, and where they are looked upon as members of an impure caste, whose dead are capable of bringing sterility and perpetual drought to the ground in which they are buried. They are skilled in improvising and reciting; and while some play the violin and guitar, the least gifted among them beat the tam-tam or play on various discordant wind-instruments. The confederation is undoubtedly of long-standing, and while the Griots, who perpetuate many ancient myths and songs, contribute towards the maintenance of some degree of intercommunication among the African races, they are credited with fomenting frequent dissensions, by trafficking with the information which they acquire through the extraordinary license

granted them of going where they will among rich and poor, both in times of war and peace.—A critical review of all that is known of the Chukches, or Yu-its, by M. J. Deniker, gives the substance of what has been learnt of the ethnological and social standing of these Arctic peoples from the narratives of Nordqvist, Nordenskjöld, the Russian Argoustinovitch, Krause, Dall, and others.

Mathematische und Naturwissenschaftliche Mittheilungen, &c. (Berlin Academy), Heft 1, 1882.—Report of work in connection with the Humboldt foundation for natural research and travel, by E. Du Bois Reymond.—The thermo-dynamics of chemical processes, by H. Helmholtz.—On abnormal forms of pine-cones, by A. W. Eichler.—On the molecular refraction of liquid organic compounds, by H. Landolt.—The embryonal excretory apparatus of the gill-less *Hylodes martinicensis*, by E. Selenka.—On the differences of phase of electric vibrations, by A. Oberbeck.—On twisted rock-crystals, by E. Reusch.—On geognostic observations by G. Schweinfurth in the desert between Cairo and Suez, by E. Beyrich.—Investigation of volcanic rocks from the region of Abu-Zabel, on the Ismailia Canal, by E. Arzruni.—On the terminal growth of phanerogam roots, by S. Schwendener.—On an abundant exhalation of sulphuretted hydrogen in the Bay of Mesolungi, by G. Von Rath.—On transformations of amide by action of bromine in presence of alkalies, by A. W. Hofmann.—On the phosphates of thallium and lithium, by C. Rammelsberg.—The present state of science, by E. du Bois-Reymond.—On the production of amides of mono-basic acids of the aliphatic series, by A. W. Hofmann.—On the production of mustard-oils, by the same.—Crystallographic researches on sublimated titanite and amphibole, by A. Arzruni.—Congratulatory addresses to Von Bischoff and to Henle on attaining their doctor-jubilees.

THE last number of the *Journal* of the Russian Chemical and Physical Society (vol. xiv. fasc. 5) contains several valuable papers. Prof. Mendeleeff contributes an interesting paper “on the heat of combustion of hydrocarbons,” and a note on his experiments on the resistance opposed by water to the motion of solid bodies.—Prof. Butleroff contributes a notice on the important question as to the variability of atomic weights, and another on the oxidation of isodibutylene by permanganate of potassium; and M. Woeikof discusses the influence of local topographical conditions of meteorological stations on the average temperatures of winter.—Besides, we notice papers on the formation of hypochlorites and chlorates during the decomposition of chlorides by means of a current, by MM. Lyadoff and Tikhomiroff.—On the separation of barium from strontium and calcium by means of chromates, by M. Meschersky.—On the structure of nitrated products of the fat series, by M. Kisel.—On the critical state of bodies, by M. Stoletoff.—On the electrical conductivity of vacuum, by M. Kraewitsch.—On vibratory telephonic signals, by M. Jacoby.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, June 15.—“On a Deep Sea Electrical Thermometer.” By C. William Siemens, D.C.L., F.R.S.

In the Bakerian Lecture for 1871, delivered before the Royal Society (*Proc. Roy. Soc.*, vol. 19, p. 443), I showed that the principle of the variation of the electrical resistance of a conductor with the temperature might be applied to the construction of a thermometer, which would be of use in cases where a mercurial thermometer is not available.

The instrument I described has since been largely used as a pyrometer for determining the temperatures of hot blasts and smelting furnaces, and Prof. A. Weinhold (*Annalen der Physik und Chemie*, 1873, p. 225), using the instrument with a differential voltmeter described in my paper referred to, found its indications to agree very closely with those of an air thermometer within the limits of his experiments from 100° to 1000° C. I am not aware, however, that any results have been published of its application to measuring temperatures where a much greater degree of accuracy is required, as in the case of deep sea observations. My friend, Prof. Agassiz, of Cambridge, U.S., ordered last year, for the American Government, an instrument designed by me for this purpose, and during the autumn it was subjected to a series of tests on board the United States Coast and Geodetic Survey steamer *Blake*, by Commander Bartlett.

The apparatus consists essentially of a coil of silk-covered iron